Water Section 2

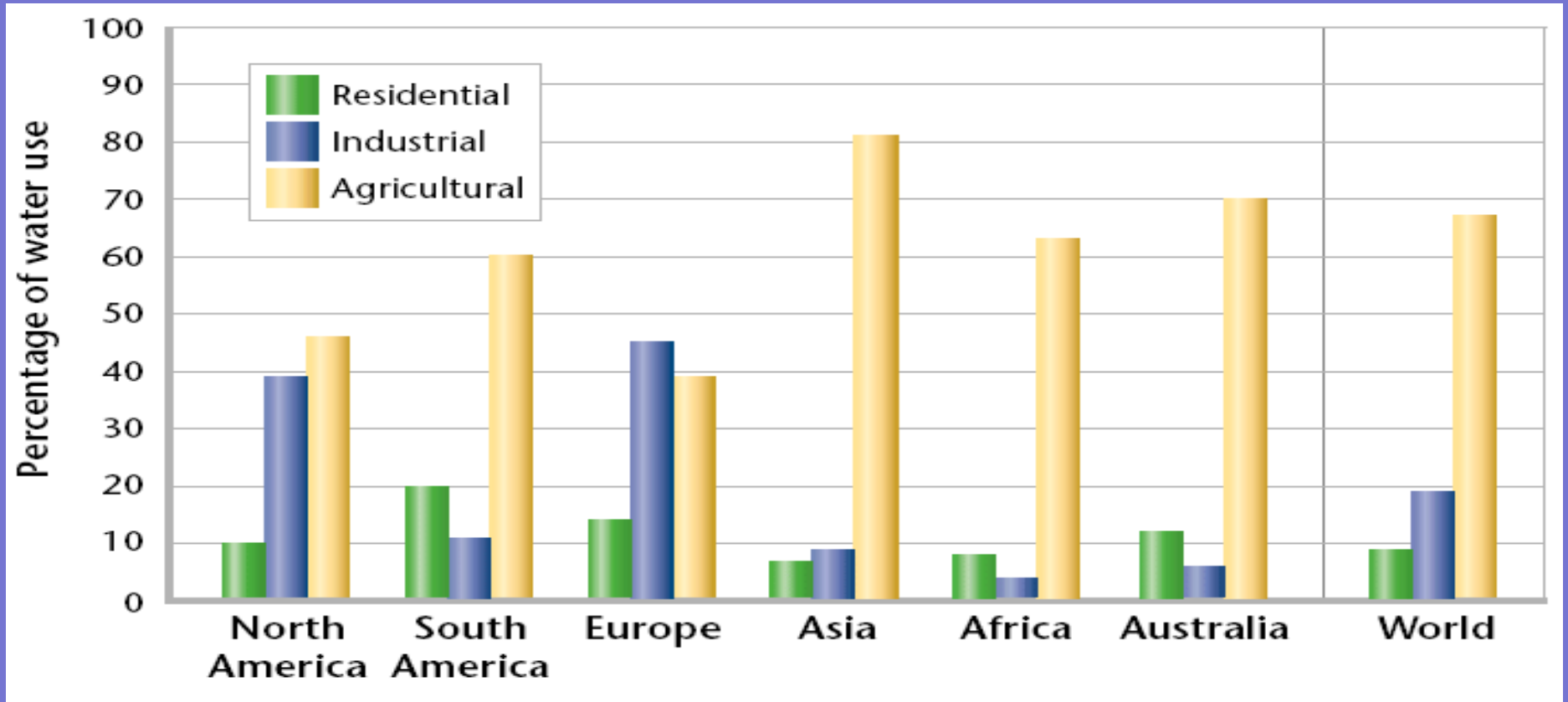
Water Use and Management

- When a water supply is polluted or overused, everyone living downstream can be affected.
- A shortage of clean, fresh water
  - one of the world's most pressing environmental problems.
  - According to the World Health Organization,
    - more than 1 billion people lack access

Global Water Use

There are three major uses for water:

1. residential use,
2. agricultural use, &
3. industrial use.



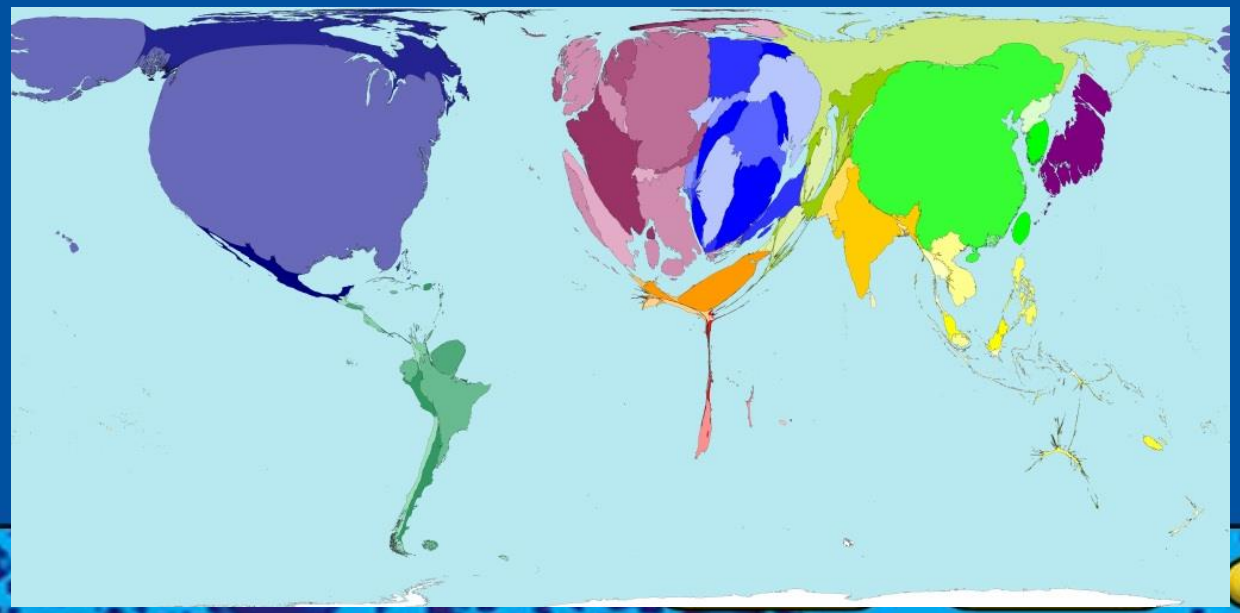
Who uses the most water?

	Residential %	Agricultural %	Industrial %
North America			
South America			
Europe			
Asia			
Africa			
Australia			
World			

Using water

Play

- Most fresh water is used to irrigate crops
- 3 things affect how people use water
  1. Availability of Water
  2. Population sizes
  3. Economic Conditions



Global Water Use

- Most of the fresh water
  - used to irrigate crops.
  - patterns of water use vary depending on
    1) The availability of fresh water,
    2) population sizes, and
    3) economic conditions

Residential Water Use

- There are striking differences in residential water use throughout the world.
  For example,
  - IN US: the average person uses about 300 L (79 gal) a day.
  - In India, the average person uses only 41 L (11 gal) a day.

In the U.S.,

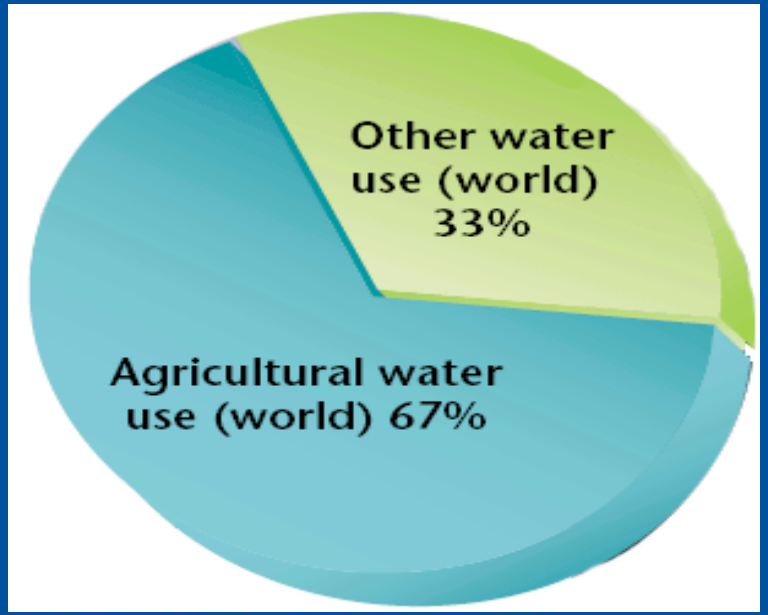
- only about half of residential water use is for activities inside the home, such as
  - Drinking
  - Flushing the toilet
  - Washing clothes/dishes and
  - Cooking.
- The remainder of the water is used for activities outside the home such as
  - watering lawns and
  - washing cars

Residential Water Use

Daily Water Use in the United States (per Person)	
Use	**Water (L)**
Lawn watering and pools	95
Toilet flushing	90
Bathing	70
Brushing teeth*	10
Cleaning (inside and outside)	20
Cooking and drinking	10
Other	5

Agricultural Water Use

- Accounts for 67 percent of the global water use
  - Plants require a lot of water to grow,
  - But as much as 80 percent of the water evaporates.



Irrigation

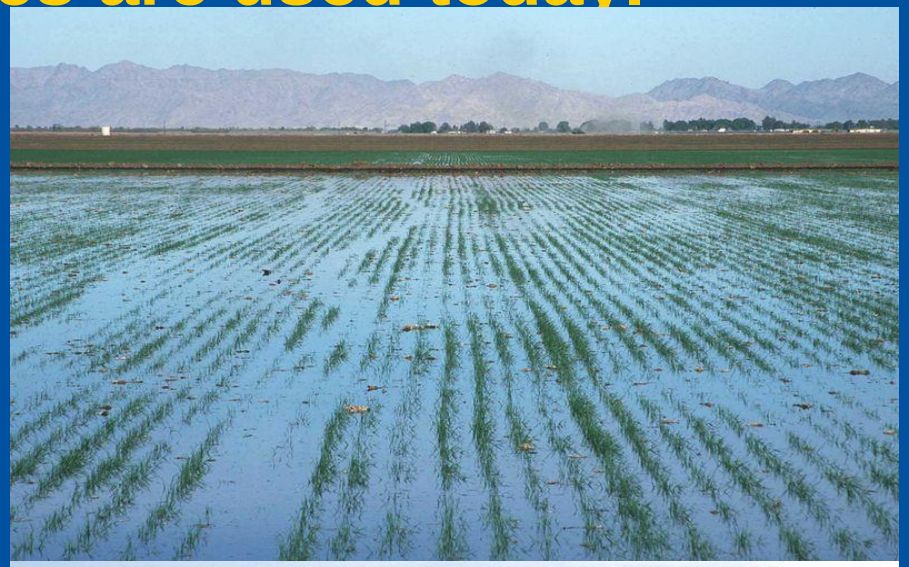
- a method of providing plants with water from sources other than direct precipitation.

Many different irrigation techniques are used today.

1. Earliest forms of irrigation were the flooding of a nearby river.

2. Irrigation by shallow, water filled ditches.

3. In the U.S., high-pressured overhead sprinklers are the most common



Main

Industrial Water Use – Make Energy!

- **Most is used to cool power plants.**
  - usually pump water from a surface water source such as a river or a lake
  - carry the water through pipes in a cooling tower, and
  - then pump the water back into the source.
- The water that is returned is
  - Usually warmer than the source,
  - but is generally clean and can be used again.

1000 L to produce 1 Kg of Aluminum

500,000 L to produce a car

Water Treatment

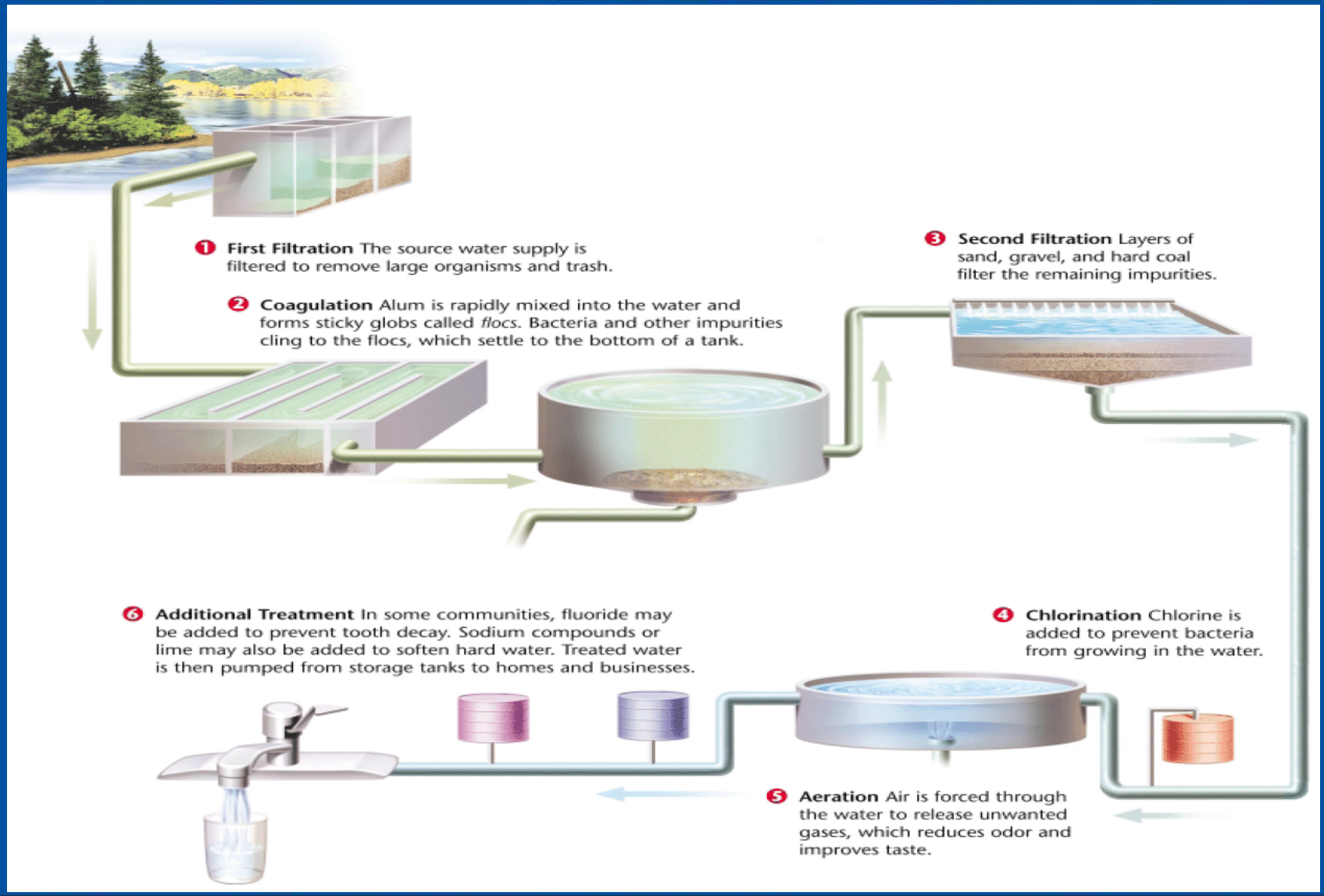
- Most water must first be made **Potable**…means suitable for drinking.
- Removes elements such as mercury, arsenic, and lead. (abiotic)
  - Found in polluted water but also naturally in ground water
- Removes pathogens such as diseases or illnesses. (biotic)
  - Bacteria, viruses, protozoa, and parasitic worms

Water Treatment

- Steps: 6 steps
    1. Filtration
        - » To remove large organisms and trash
    2. Coagulation
        - » Aluminum is added to form sticky globs (flocs) so bacteria and impurities stick to flocs and settle @ bottom
    3. Filtration
        - » Layers of sand, gravel, and hard coal used to filter

Water Treatment

4. Chlorination
   - » Added to prevent bacterial growth
5. Aerations
   - » Air is forced through water to release unwanted gases to reduce odor and improve taste
6. Additives
   - » Fluorine added to prevent tooth decay, Sodium or lime to soften water



Water Management Projects

- People often prefer to live in areas where
  - the natural distribution of surface water is inadequate.
  - Water management projects, such as dams, are designed to meet these needs.
- Water management projects can have various goals,
  1. bringing in water to make a dry area habitable,
  2. creating a reservoir for drinking water, or
  3. generating electric power, which then allows people to live and grow crops in desert areas.

Dams and Reservoirs

- A **dam**
  - a structure that is built across a river to control a river's flow, usually creating an artificial body of water (**reservoir**)
  - **GA** has the highest density of dams in SE
    - Oconee, Lanier, Hartwell, Sinclair, Allatoona
  - Water can be used for
    - flood control,
    - drinking water,
    - irrigation,
    - recreation,
    - industry.

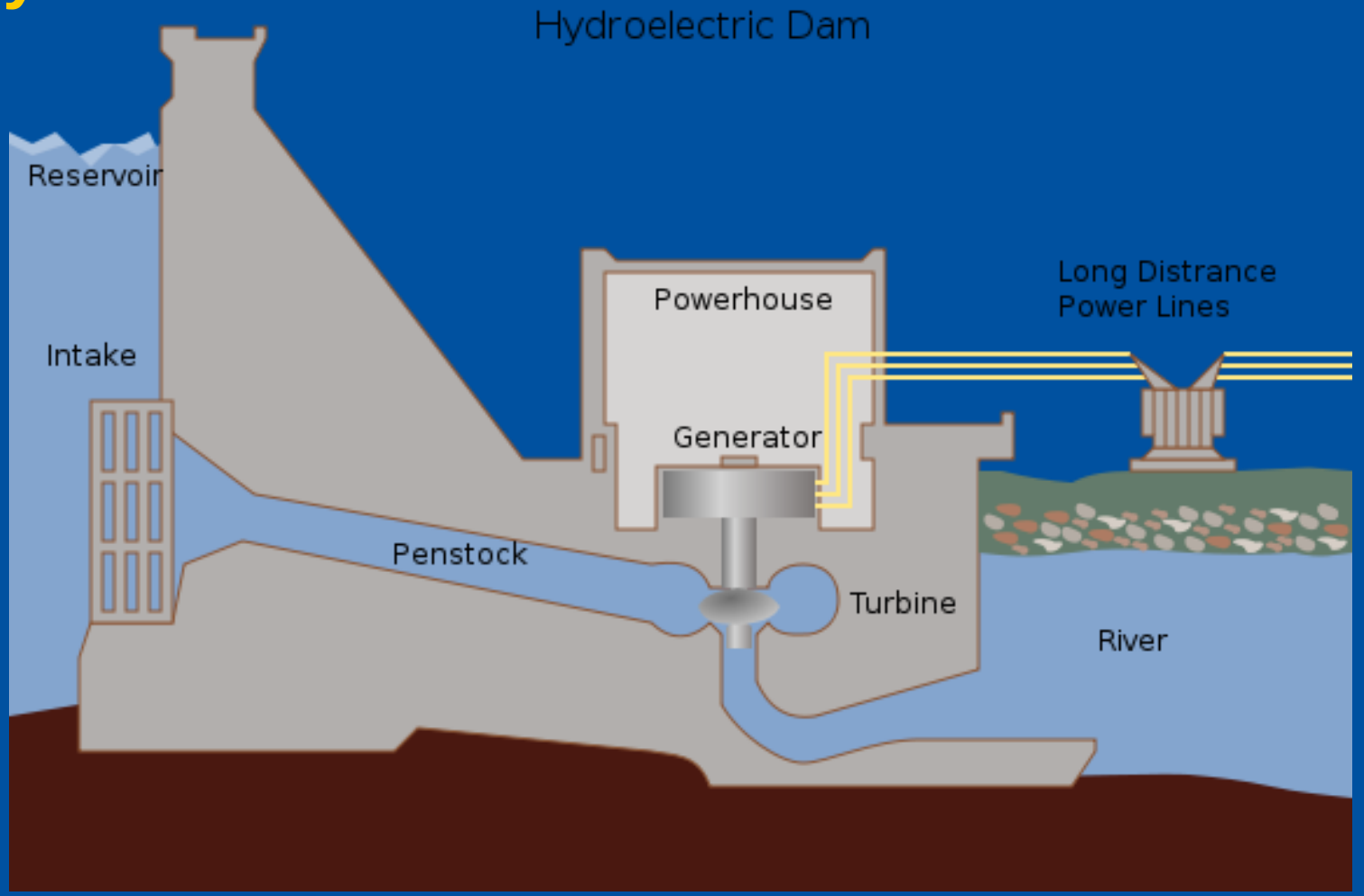
Play

Hydroelectric dams

- use the power of flowing water to turn a turbine that generates electrical energy.
- About 20 percent of the world electrical energy is generated using this method.

Three Gorges Dam: Largest in the world; located in china along the Yangtze River

Hydroelectric Dam



Effects of Dams

- But, interrupting a river's flow can have consequences.
  - when the land behind a dam is flooded,
    - people are displaced, and
    - entire ecosystems can be destroyed.
  - Fertile sediment also builds up behind a dam
    - instead of enriching the land farther down the river, and
    - farmland below may be less productive.
- **Dam failure/bursts,**
  - the people living along the river below may be killed.

Diversion Canal

- To supply dry regions with water,
  - all or part of a river can be diverted into canals that carry water across great distances.
- The Colorado River
  - begins as a glacial stream in the Rocky Mountains
  - quickly grows larger as other streams feed into it.
  - As the river flows south, it is divided to meet the needs of 7 states.
  - So much of the river's water is diverted for irrigation and drinking water that the river runs dry before it reaches the Gulf of California.

What Are the Benefits of Water Conservation?

Water conservation enables a local water provider to:

1. meet its supply needs adequately with reliable water
2. save water management costs

BOTH AT THE SAME TIME.

Water Conservation

- As water sources become depleted, water becomes more expensive.
  - wells must be dug deeper,
  - water must be piped greater distances, and
  - polluted water must be cleaned up before it can be used.
- Ensures that everyone will have enough water at a reasonable price.

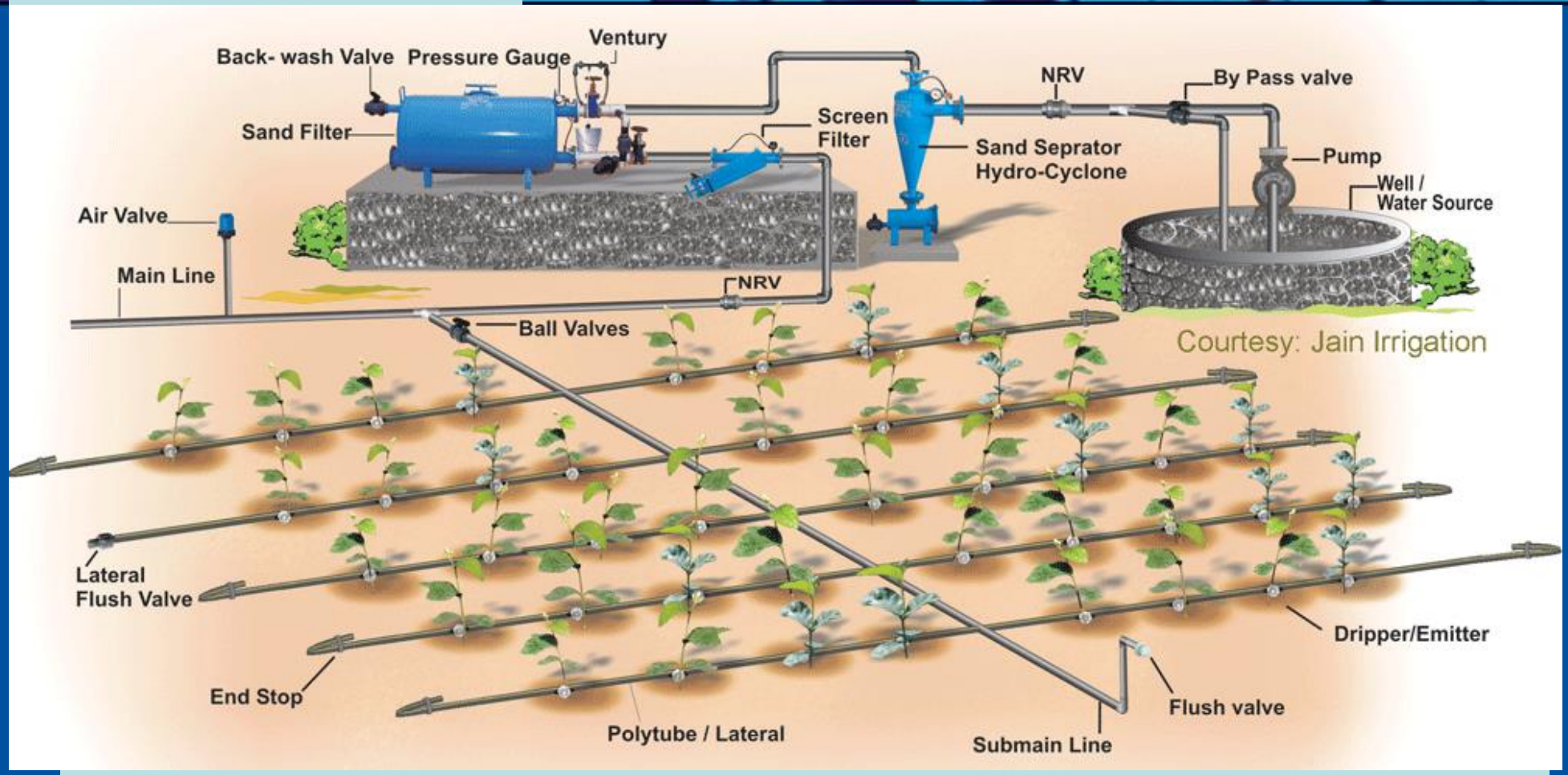
Water Conservation in Agriculture

- Most of the water loss in agriculture comes from:
  - evaporation,
  - seepage, and
  - runoff,
- So technologies that reduce these problems go a long way toward conserving water.

Drip irrigation systems

- They deliver small amounts of water directly to plant roots by using perforated tubing.
- Water is released to plants as needed and at a controlled rate.

Drip Irrigation



Water is delivered at or near the root zone of plants, drop by drop. This method can be the most water-efficient method of irrigation, if managed properly, since evaporation and runoff are minimized.

Water Conservation in Industry

- The most widely used water conservation practices involve the recycling of:
  - cooling water and
  - wastewater.
- Instead of discharging used water into a nearby river, businesses often recycle water and use it again.
- Paper Production now requires 30% less water than 50 years ago

Water Conservation at Home

What You Can Do to Conserve Water

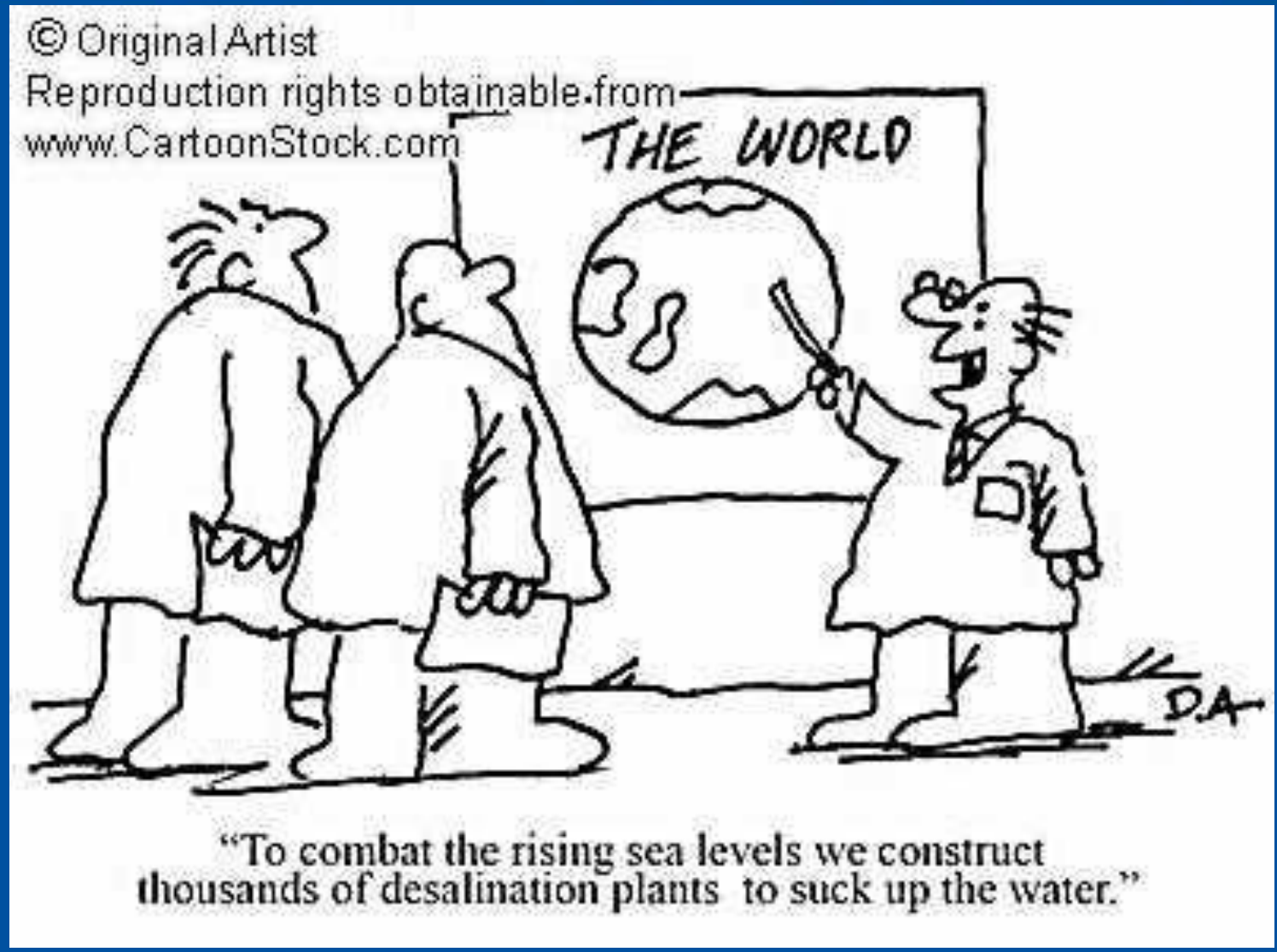
- Take shorter showers, and avoid taking baths unless you keep the water level low.
- Install a low-flow shower head in your shower.
- Install inexpensive, low-flow aerators in your water faucets at home.
- Purchase a modern, low-flow toilet, install a water-saving device in your toilet, or simply place a water-filled bottle inside your toilet tank to reduce the water used for each flush.
- Do not let the water run while you are brushing your teeth.
- Fill up the sink basin rather than letting the water run when you are shaving, washing your hands or face, or washing dishes.
- Wash only full loads in your dishwasher and washing machine.
- Water your lawn sparingly.

Water Conservation at Home Includes

- Changing a few everyday habits like using only the water that they need.
  - Turning off water while brushing teeth
  - Shorter showers
  - Washing full loads of dishes &/or clothes
  - *(other?)*
- Water-saving technology, such as low-flow toilets & shower heads
- Watering lawns at night to reduce the amount of evaporation.
- **Xeriscaping**, or designing a landscape that requires minimal water use.

Solutions for the Future

- In some places, conservation alone is not enough to prevent water shortages, and as populations grow, other sources of fresh water need to be developed.
- Two possible solutions are:
  1. Desalination
  2. Transporting Fresh Water



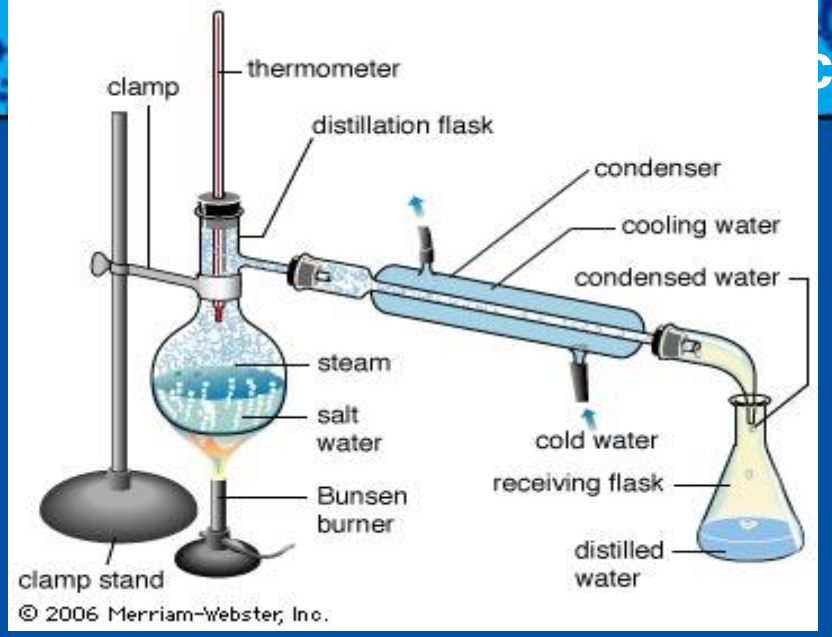
"To combat the rising sea levels we construct thousands of desalination plants to suck up the water."

Desalination

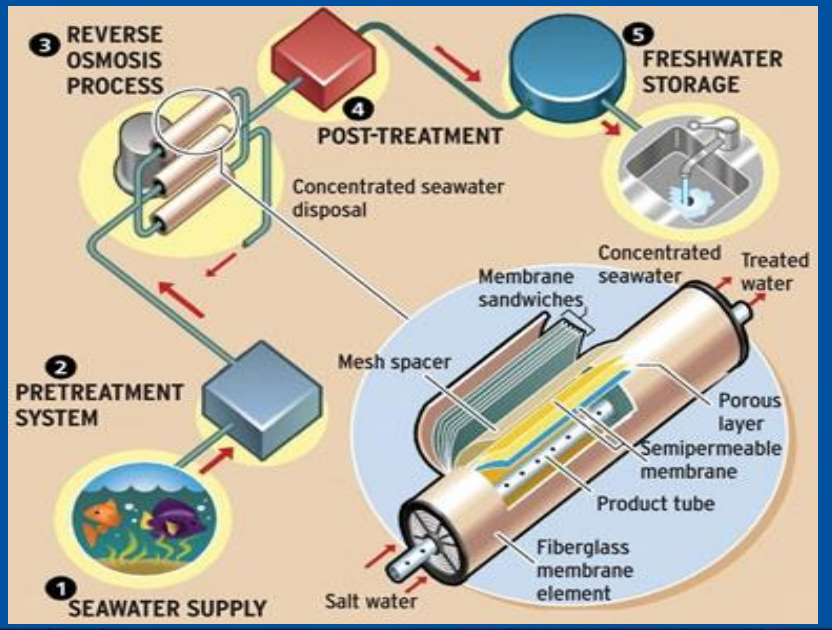
- the process of removing salt from ocean water.
- Some countries in drier parts of the world, such as the Middle East,
  - have built desalination plants to provide fresh water.
  - Most desalination plants heat salt water and collect the fresh water that evaporates.
- **Consumes a lot of energy, & therefore the process is too expensive for many nations to consider.**

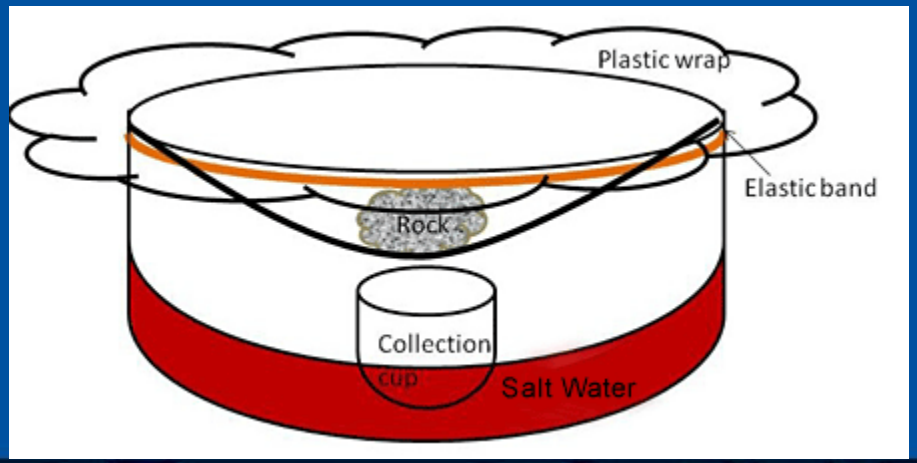
Methods

- Distillation (heat)



- Reverse Osmosis (filters/membranes)





Transporting Water

- In some areas of the world where freshwater resources are not adequate, water can be transported from other regions.

For example,

- Ships regularly travel from the mainland to the Greek islands towing bags of water.
- The ships anchor in port, and fresh water is then pumped onto the islands.

- This bag solution is also being considered in the United States, where almost half of the available fresh water is in Alaska.

Icebergs

- 76 % of the Earth's fresh water is frozen in icecaps,
- For years, people have considered
  - towing icebergs to communities that lack fresh water.
  - But no efficient way to tow icebergs